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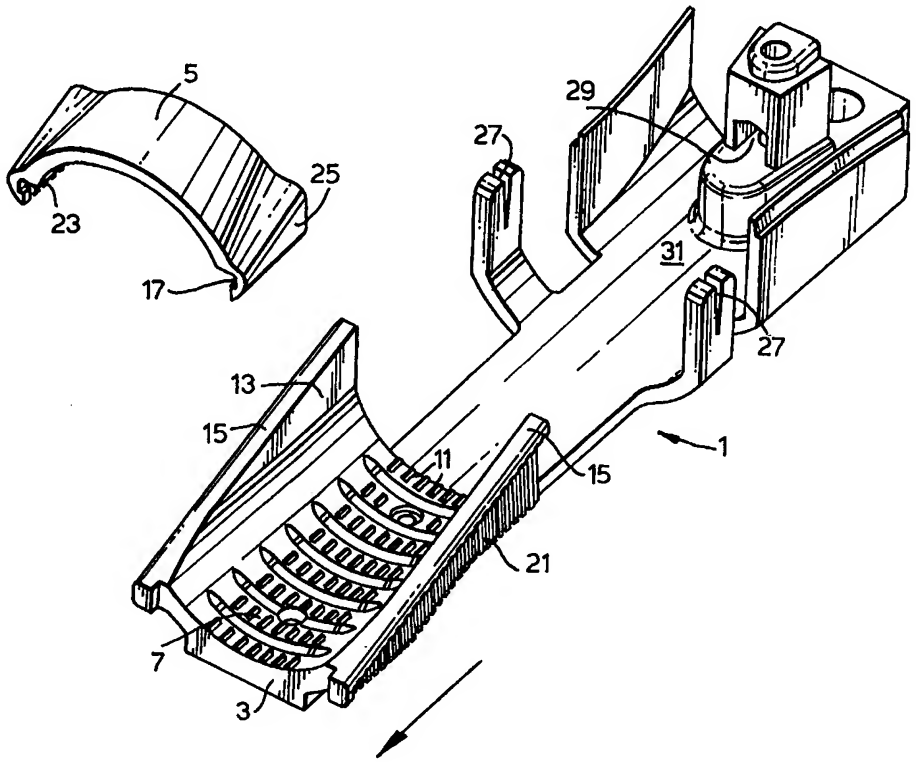
(54) Title: CABLE CLAMP

(57) Abstract

A clamp for a cable, comprising first and second clamping parts which are arranged to surround part of a cable, each clamping part including a clamping surface which is arranged to grip a cable, and also including attachment means by which the clamping part is slidably attached or attachable to the other part, each attachment means being inclined with respect to an axis of the clamp, which axis is arranged to be substantially coaxial with the axis of a clamped cable, such that when the clamping parts slide with respect to each other in a first axial direction, their clamping surfaces move closer together, thereby gripping the cable between them, and when they slide with respect to each other in a second, opposite, axial direction, their clamping surfaces move further apart, thereby releasing their grip on the cable.



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Cable Clamp

This invention relates to cable clamps. However, while the invention comprises a new clamp which is suitable for clamping cables, e.g. optical fibre cables, electrical cables or wires, it may also be suitable for clamping other elongate objects, e.g. hoses or pipes.

There are many different designs of cable clamps, from simple designs of the "hose clamp" type to more expensive and sophisticated designs. However, the inventors of the present invention have discovered that effective cable clamps tend to be bulky, complex and expensive, whereas compact, simple and inexpensive cable clamps tend not to be very effective. The inventors have invented a new cable clamp which is highly effective but which need not be bulky, complex or expensive.

A first aspect of the invention provides a clamp for a cable, comprising first and second clamping parts which are arranged to surround part of a cable, each clamping part including a clamping surface which is arranged to grip a cable, and also including attachment means by which the clamping part is slidably attached or attachable to the other part, each attachment means being inclined with respect to an axis of the clamp, which axis is arranged to be substantially coaxial with the axis of a clamped cable, such that when the clamping parts slide with respect to each other in a first axial direction, their clamping surfaces move closer together, thereby gripping the cable between them, and when they slide with respect to each other in a second, opposite, axial direction, their clamping surfaces move further apart, thereby releasing their grip on the cable.

Because the clamping surfaces of the clamping parts are able to move closer together and further apart by means of relative axial movement, the clamp has the advantage of "self-tightening", i.e. an axial movement of the cable may itself induce an increase in the clamping grip on the cable. Furthermore, the clamp according to the

invention has the special advantage that this self-tightening feature is provided in a simple and non-bulky way. This is due to the fact that the self-tightening feature is achieved by means of the two clamping parts being slidably attached (or attachable) to each other by means of the inclined attachment means. This arrangement substantially avoids the necessity of providing an outer part in which the clamping parts are received, thereby (in most cases) reducing the size of the clamp and the number of parts which are required. It also has the advantage of permitting a simple way of achieving "side-entry" of the cable into the clamp (i.e. not requiring an end of the cable to be fed through the clamp), because it will normally be possible to provide for the separation (or at least opening-out) of the two clamping parts.

For the avoidance of doubt, when it is stated in this specification that the clamping parts are slidable with respect to each other, this includes the possibility that the sliding may be assisted by means of rollers or ball bearings or the like.

In preferred embodiments of the invention, each clamping part of the clamp includes at least two attachment means, the attachment means preferably being located on substantially opposite sides of the axis of the clamp. Each attachment means preferably comprises a rail or a groove which may slide in a groove or on a rail, respectively, of the other clamping part. Each groove it preferably elongate, i.e. in the form of a channel, but alternatively the grooves may comprise short recesses, or hook members or the like. The first clamping part may comprise a clamping surface and at least two raised side parts (e.g. side walls), the raised side parts being situated on opposite (radial) sides of the clamping surface, each raised side part including a respective attachment means of the first clamping part. For example, the or each attachment means (e.g. one or more rails and/or grooves) of each raised side part may be situated at or near the top edge of the raised side part (i.e. at or near the edge furthest removed from the clamping surface of the first clamping part). Most preferably, the top edge of each raised side part is inclined with respect to the axis of the clamp.

Advantageously, the clamping parts may be ratcheted such that an accidental sliding of the parts with respect to each other in the second axial direction is substantially prevented. For embodiments which have raised side parts, at least one of the raised side parts preferably includes a series of ratchet teeth which are arranged to form a ratchet with at least one corresponding ratchet tooth of the second clamping part.

The second clamping part of the clamp preferably has a shorter axial length than that of the first clamping part. Preferably, in use, a cable to be clamped is placed in the first (main) clamping part of the clamp, and the (smaller) second clamping part is slid with respect to both the first clamping part and the cable in the first axial direction, thereby causing the clamping surfaces of the two clamping parts to be moved radially closer together, consequently causing the cable to be gripped between them.

A cable will normally be clamped at or near an end thereof (and the optical fibres or wires of the cable may extend beyond this end, for example to be spliced with other cables). The first axial direction is therefore preferably in the axial direction towards the cable from its end, e.g. so that an axial pulling force on the cable will tend to cause the grip on the cable by the clamp to increase.

Each clamping surface of the clamp is preferably substantially parallel to the axis of the clamp. This has the advantage of maximising the surface area of the clamping surfaces which contacts the cable. Alternatively, however, one or both clamping surfaces may be inclined with respect to the axis of the clamp, e.g. in order to enhance the effect of the increase in gripping force if the cable is pulled in the first axial direction. In either case, each clamping surface preferably includes a plurality of gripping teeth, in order to enhance the grip on the cable.

In some preferred embodiments, at least part of at least one of the clamping surfaces (preferably the clamping surface of the first clamping part), is movable (e.g.

by means of one or more screws or the like) with respect to the clamping surface of the other clamping part in a radial direction otherwise than by sliding axially. This has the advantage of providing an extra degree of adjustability (e.g. to adjust to the diameter of a particular cable). This may be useful, for example, to ensure that the axis of the clamped cable is in the most optimum position (especially to ensure that the cable axis is substantially coaxial with the axis of the clamp). This may aid routing of the wires or optical fibres from a clamped end of the cable, or it may aid the securement of a strength member of an optical fibre cable.

As well as, or as an alternative to, the clamping surface(s) being radially movable in this way, the clamp may include at least one clamping insert which has a clamping surface. The or each clamping insert is preferably attachable to the clamping surface of at least one of the clamping parts (preferably that of the first clamping part) such that the clamping surface of the insert in effect replaces that of the clamping part. This may have the same uses and advantages as described in the paragraph above.

Advantageously, some embodiments of the clamp may include one or more wedge parts which may be inserted between one or both clamping surfaces and a clamped cable. This provides the possibility of yet further increased securement of a cable in the clamp particularly, for example, against torsional (twisting) movements.

As already mentioned, one preferred use of the clamp according to the invention is to clamp an end region of a cable, e.g. an optical fibre cable. For such a use, therefore, the clamp preferably includes at least one securement device for securement of a strength member of an optical fibre cable to the clamp. The or each securement device is preferably axially spaced from the clamping surfaces, and joined to the clamping surfaces by one or more structural members of the clamp. The securement devices may, for example, comprise jaws or the like for securing a central strength member, and/or one or more slits or the like for trapping aramid fibres.

Additionally or alternatively, the clamp may comprise a fan-out part for fanning out optical fibres extending from a clamped optical fibre cable. The fan-out part is likewise preferably axially spaced from the clamping surfaces, and joined to the clamping surfaces by one or more structural members of the clamp.

The clamp is preferably formed from metal and/or a plastics material. It is preferably cast or moulded.

The clamp according to the first aspect of the invention may, for example, clamp a cable with respect to a cable splice closure, an interconnection cabinet, or a distribution rack (e.g. a shelf of a distribution rack).

A second aspect of the invention therefore provides a cable splice closure, an interconnection cabinet, or a distribution rack, including a clamp according to the first aspect of the invention.

The invention will now be described, by way of example, with reference to the accompanying drawings, of which:

Figure 1 is a perspective view of a clamp according to the invention;

Figure 2 is a perspective view of a substantially identical clamp according to the invention which includes wedge parts and which is clamped onto a cable;

Figure 3 is a side view of a clamp according to the invention, which is substantially the same as the clamps illustrated in Figures 1 and 2;

Figure 4 is a cross-sectional view of the clamp illustrated in Figure 3; and

Figures 5 and 6 are cross-sectional views of two further clamps according to the invention.

Figure 1 shows a clamp 1 comprising a first clamping part 3 and a second clamping part 5 (shown separate from the first clamping part). The first clamping part 3 includes a clamping surface 7, and the second clamping part 5 includes a clamping surface 9 (not shown in Figure 1, but shown in figures 4 to 6). Each clamping surface is arranged to grip a cable (or other elongate object, e.g. a hose), and to this end has a plurality of gripping teeth 11.

The first clamping part 3 includes two raised side parts 13 (in the form of side walls) which are situated on opposite sides of the clamping surface 7. The top edges 15 of the raised side parts 13 are inclined with respect to the axis of the clamp 1 (shown as a dashed line). These top edges 15 comprise attachment rails which are arranged to be slidably received in attachment grooves 17 in the second clamping part 5 when the two clamping parts are attached together, as shown in Figure 2. Because the attachment rails 15 of the first clamping part 3 are inclined with respect to the axis of the clamp (and the attachment grooves 17 of the second clamping part 5 are also inclined with respect to the axis of the clamp when the second clamping part is attached to the first clamping part), the two clamping surfaces 7, 9 move closer together when the second clamping part 5 slides along the rails 15 in the first axial direction (shown by the arrow). As shown in Figure 2, when a cable 19 is placed between the clamping surfaces, this axial movement causes the two clamping parts (and specifically their clamping surfaces) to grip the cable. Any further movement of the cable 19 in the first axial direction will tend to tighten the grip of the clamping parts on the cable (i.e. the clamp is "self-tightening").

As shown in Figures 1 to 3, each raised side part 13 of the first clamping part 3 has a series of ratchet teeth 21 on its outer surface. These ratchet teeth 21 engage with another series of ratchet teeth 23 on the internal surface of each side wall 25 of the second clamping part 5 to prevent accidental movement of the second clamping part relative to the first clamping part in the second axial direction (i.e. in the direction

opposite to that of the arrow). This ratcheting therefore substantially prevents accidental loosening of the clamping grip on the cable.

The clamps illustrated in the figures are particularly adapted for clamping optical fibre cables. To this end they have securement devices for optical fibre cable strength members, and a fan-out part for fanning out optical fibres extending from a clamped cable. There are two types of securement devices. Firstly, there are slits 27 for trapping aramid (e.g. Kevlar - trade mark) fibres. Secondly, there is an axial screw driven jaw member 29 for securing a central (i.e. axial) strength member. The fan-out part of the clamp comprises a bifurcated region 31 for dividing the optical fibres extending from a clamped, terminated, cable into two separate bundles. There is a removable cover 33 which is attachable to the securement devices and the fan-out part (this cover is not illustrated in Figure 1).

Illustrated in Figure 2 are a pair of wedge parts 35 which have been inserted on radially opposite sides of the cable 19, between the cable and the clamping surfaces. These wedge parts may help to enhance the grip on the cable, particularly to prevent the cable from twisting.

Figure 3 is a side view of a clamp substantially as shown in figures 1 and 2. The same clamp is shown in axial cross-section in Figure 4. Angle X is the angle of inclination of the attachment means (specifically the attachment rails 15) with respect to the axis of the clamp. This angle of inclination is preferably in the range 10° to 50°, more preferably in the range 15° to 30°. As illustrated, the angle of inclination is about 21°. Angle Y is an angle of inclination of the clamping surface of the first clamping part with respect to the axis of the clamp. This angle may help to enhance the grip on the cable against cable movement in the first axial direction. Angle Y is preferably in the range 1° to 6°; as illustrated it is 2.5°.

Figures 5 and 6 illustrate similar clamps (in axial cross-section). The clamp of Figure 5 has a clamping surface of its first clamping part which is movable with

respect to the clamping surface of the second clamping part otherwise than by sliding axially. This movement is effected by means of screws 37. The clamp of Figure 6 has a clamping insert 39 which is attachable to the clamping surface of the first clamping part, such that the clamping surface of the insert in effect replaces that of the first clamping part.

All of the illustrated clamps may be attached to a closure or a cabinet etc. by means of bracket 41.

Claims

1. A clamp for a cable, comprising first and second clamping parts which are arranged to surround part of a cable, each clamping part including a clamping surface which is arranged to grip a cable, and also including attachment means by which the clamping part is slidably attached or attachable to the other part, each attachment means being inclined with respect to an axis of the clamp, which axis is arranged to be substantially coaxial with the axis of a clamped cable, such that when the clamping parts slide with respect to each other in a first axial direction, their clamping surfaces move closer together, thereby gripping the cable between them, and when they slide with respect to each other in a second, opposite, axial direction, their clamping surfaces move further apart, thereby releasing their grip on the cable.

2. A clamp according to Claim 1, in which each clamping part includes at least two attachment means, the attachment means being located on substantially opposite sides of the axis of the clamp.

3. A clamp according to Claim 1 or Claim 2, in which each attachment means comprises a rail or a groove which may slide in a groove or on a rail, respectively, of the other clamping part.

4. A clamp according to any preceding claim, in which the clamping parts are ratcheted such that an accidental sliding of the parts with respect to each other in the second axial direction is substantially prevented.

5. A clamp according to any preceding claim, in which the first clamping part comprises a said clamping surface and at least two raised side parts, the raised side parts being situated on opposite radial sides of the clamping surface, each raised side part including a respective attachment means of the first clamping part.

6. A clamp according to Claim 5 when dependent upon Claim 4, in which at least one of the raised side parts includes a series of ratchet teeth which are arranged to form a ratchet with at least one corresponding ratchet tooth of the second clamping part.

7. A clamp according to any preceding claim, in which the second clamping part has a shorter axial length than that of the first clamping part.

8. A clamp according to any preceding claim, in which each clamping surface is substantially parallel to the axis of the clamp.

9. A clamp according to any preceding claim, in which each clamping surface includes a plurality of gripping teeth.

10. A clamp according to any preceding claim, in which at least part of at least one of the clamping surfaces (preferably the clamping surface of the first clamping part), is movable with respect to the clamping surface of the other clamping part in a radial direction otherwise than by sliding axially.

11. A clamp according to any preceding claim, further comprising at least one clamping insert which includes a clamping surface, the clamping insert being attachable to the clamping surface of at least one of the clamping parts (preferably the clamping surface of the first clamping part) such that the clamping surface of the insert in effect replaces that of the clamping part.

12. A clamp according to any preceding claim, further comprising one or more wedge parts which may be inserted between one or both clamping surfaces and a clamped cable.

13. A clamp according to any preceding claim, which further comprises at least one securement device for securement of a strength member of a clamped optical fibre cable thereto.

14. A clamp according to any preceding claim, which further comprises a fan-out part for fanning out optical fibres extending from a clamped optical fibre cable.

15. A cable splice closure, an interconnection cabinet, or a distribution rack including a clamp according to any preceding claim.

Fig.1.

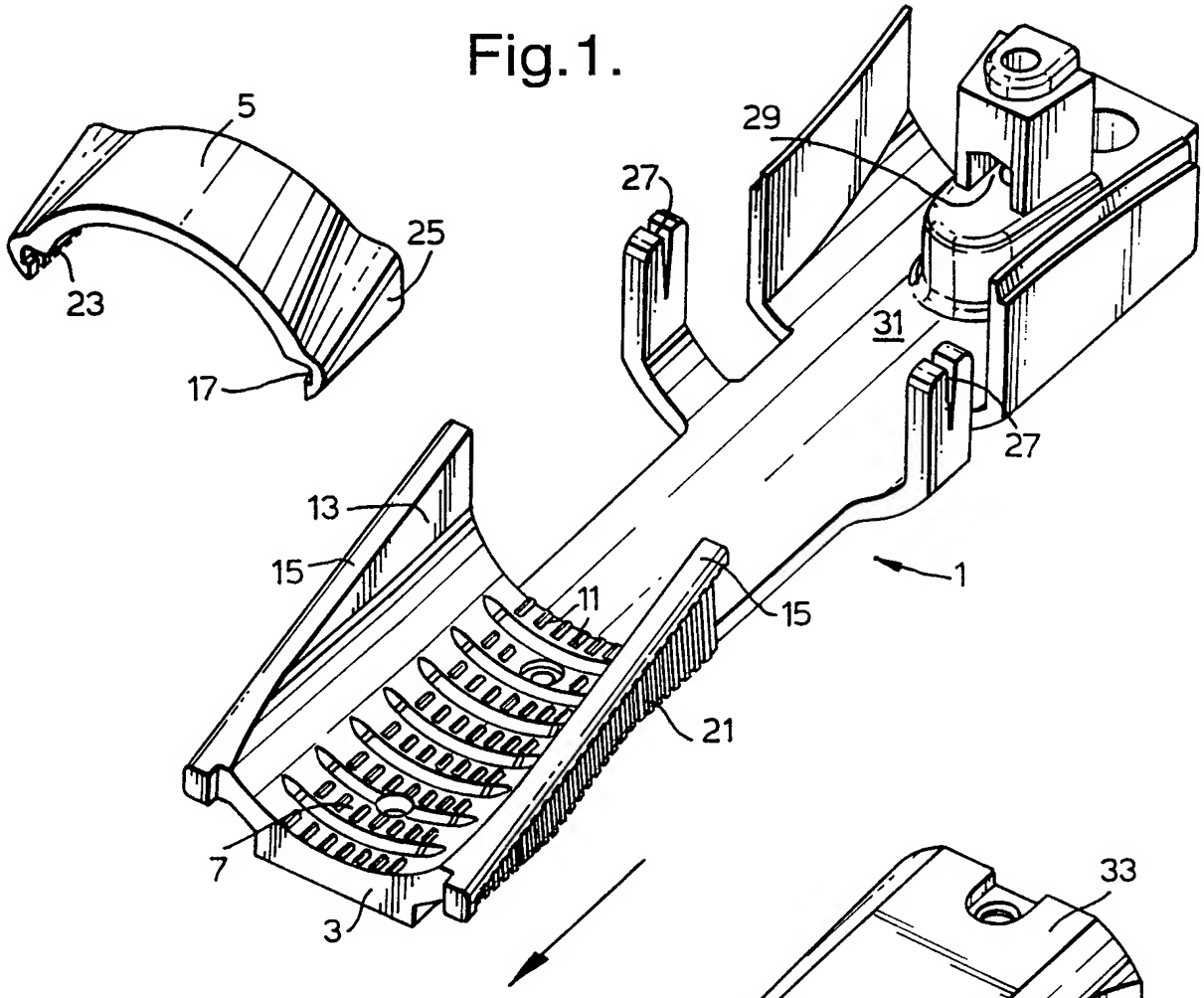
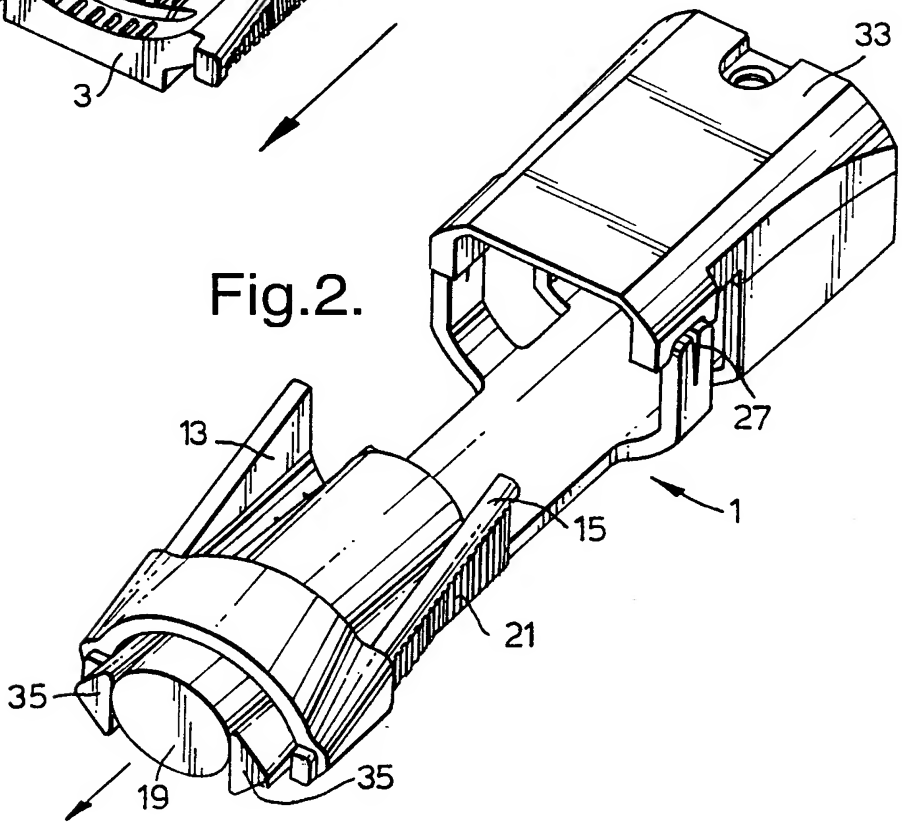


Fig.2.



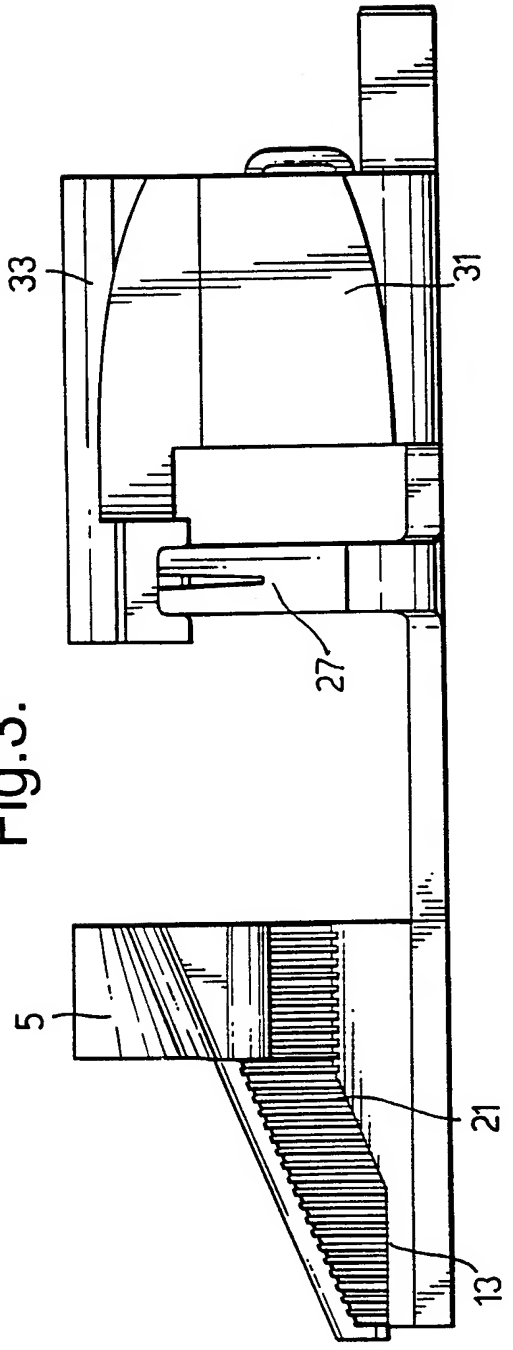


Fig.3.

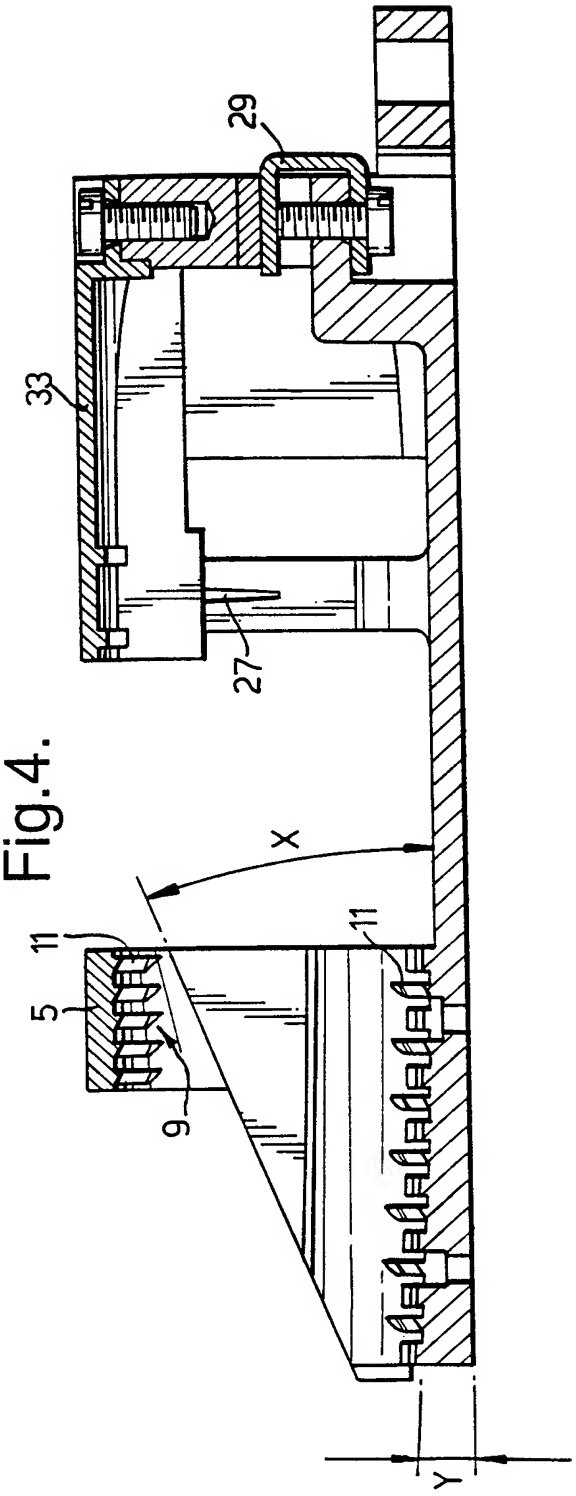


Fig.4.

Fig.5.

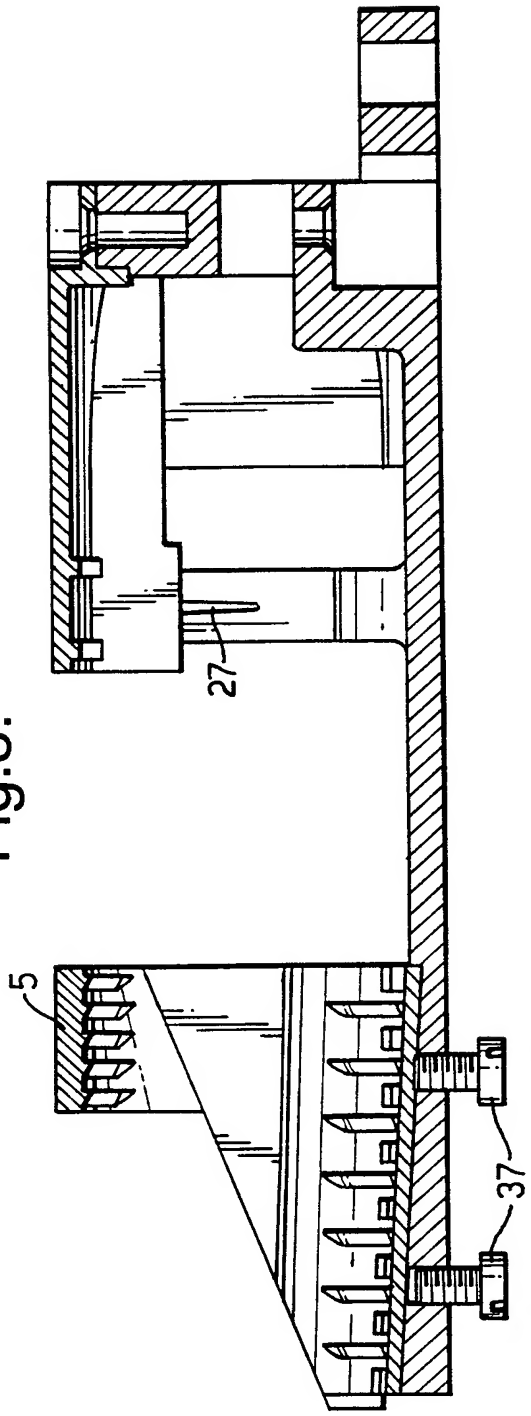
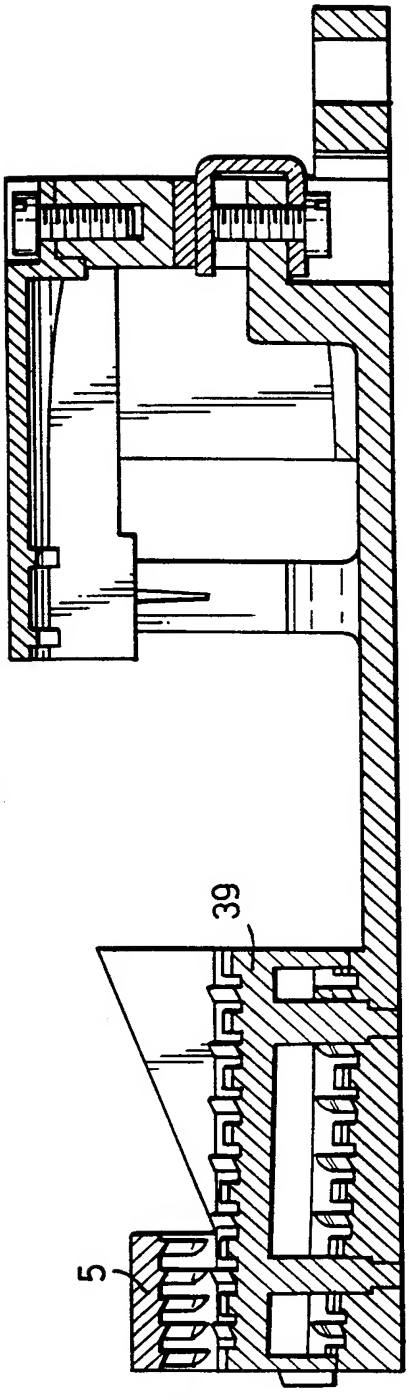


Fig.6.



INTERNATIONAL SEARCH REPORT

In. .tional Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H02G7/05 H01R13/585 F16L3/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H02G H01R F16L F16G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	GB 1 358 129 A (RELIABLE ELECTRIC COMPANY) 26 June 1974 see page 1, ne 39 - line 70 see page 2, line 14 - line 99 see figures 1-4	1-3,5,7, 8,10,11 9
X	FR 1 498 867 A (H. CHADEFAUD ET CIE) 20 October 1967 see the whole document	1-3,5,7, 8,10,11
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[X] Further documents are listed in the continuation of box C.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

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